

optical surfaces, in order to minimize reflection losses and prolong their lifetime.

Also, the gas composition for the excimer or molecular fluorine laser in the above configurations uses either helium, neon, or a mixture of helium and neon as a buffer gas. For rare gas-halide excimer lasers, the rare gas is preferably maintained at a concentration of around 1.0% in the gas mixture. The concentration of fluorine in the gas mixture preferably ranges from 0.003% to around 1.0%, and is preferably around 0.1%. However, if the total pressure is reduced for narrowing the bandwidth, then the fluorine concentration may be higher than 0.1%, such as may be maintained between 1 and 7 mbar, and more preferably around 3-5 mbar, notwithstanding the total pressure in the tube or the percentage concentration of the halogen in the gas mixture. The addition of a trace amount of xenon, and/or argon, and /or oxygen, and/or krypton and/or other gases (see the '025 application) may be used for increasing the energy stability, burst control, and/or output energy of the laser beam. The concentration of xenon, argon, oxygen, or krypton in the mixture as a gas additive may range from 0.0001% to 0.1%, and would be preferably significantly below 0.1%. Some alternative gas configurations including trace gas additives are set forth at U.S. patent application no. 09/513,025 and U.S. patent no. 6,157,662, each of which is assigned to the same assignee and is hereby incorporated by reference.

A line-narrowed oscillator, e.g., a set forth above, may be followed by a power amplifier for increasing the power of the beam output by the oscillator. Preferred features of the oscillator-amplifier set-up are set forth at U.S. patent applications no. 09/599,130 and 60/228,184, which are assigned to the same assignee and are hereby incorporated by reference. The amplifier may be the same or a separate discharge chamber 102. An optical or electrical delay may be used to time the electrical discharge at the amplifier with the reaching of the optical pulse from the oscillator at the amplifier. With particular respect to the F₂-laser, a molecular fluorine laser oscillator may have an advantageous output coupler having a transmission interference maximum at λ_1 and a minimum at λ_2 . A 157 nm beam is output from the output coupler

and is incident at the amplifier of this embodiment to increase the power of the beam. Thus, a very narrow bandwidth beam is achieved with high suppression of the secondary line λ_2 and high power (at least several Watts to more than 10 Watts).

While exemplary drawings and specific embodiments of the present invention have been described and illustrated, it is to be understood that the scope of the present invention is not to be limited to the particular embodiments discussed. Thus, the embodiments shall be regarded as illustrative rather than restrictive, and it should be understood that variations may be made in those embodiments by workers skilled in the arts without departing from the scope of the present invention, as defined by the claims below, and structural and functional equivalents thereof.

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